2013 Experimental Warning Program (2013-EWP) blog posted by forecasters with comments on Variational Local Analysis and Prediction System (vLAPS)

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1. Background

During the Spring 2013 Experimental Warning Program (2013-EWP), forecasters evaluated meteorological products of interest, and maintained a blog. Forecasters were free to post and discuss their experiences with many products. Listed here are all comments posted by forecasters with regard to the performance of variational Local Analysis and Prediction System (vLAPS). These posts are archived at National Severe Storms Laboratory (NSSL) with logging in requirement. Thus we made it available for interested Bulletin of The American Meteorological Society (BAMS) readers easy access. Credit should be given to NOAA's NSSL for use of any of these materials.

Whenever LAPS was mentioned, it meant to be vLAPS. The vLAPS/ARW 1-km forecast is labeled as 1km OUN domain, while the vLAPS/ARW 3-km forecast is labled as 3 km OUN domain. These products were the same name used on AWIPS II machines during the 2013-EWP.

2. Blog

2.1 3-D configuration vLAPS/ARW forecast in two regional domains: 1-km, and 3-km for supporting nowcast applications

Mesoscale Discussion for 05/09 2230Z Update

Posted on May 8, 2013 by Gabe Garfield

The 19Z LAPS forecast (1km OUN domain) appears to correctly capture some of the convection in Oklahoma and up into Kansas, but it did not accurately depict the mode of convection along the dryline. While the LAPS forecast shows several areas of convective clusters, the radar analysis shows a line of discrete supercells.

8 May 2013 2100 UTC Mesoscale Discussion

Posted on May 8, 2013 by greg.stumpf

LAPS analysis from the 1 km OUN domain continues to do a decent job with the placement of the composite reflectivity across western OK. Interestingly enought the 21z LAPS shows a clean swath of 2200 to 2600 J/Kg SBCAPE spreading northward across western north Texas, with another pocket of 2000 to 2500 J/Kg SBCAPE near the OK/KS border, which would be nearer the sfc low which continues to churn E/NE across the TX panhandle.
Kurtz/Hatzos

3 km LAPS Forecasts Decently Predicting Convection

Posted on May 9, 2013 by greg.stumpf

The 18z 3 km LAPS forecast of surface layer maximum base reflectivity has done a decent job predicting the location and track of new updrafts across central Texas, within SJT's CWA. The below image contains the 1945z forecast of surface max reflectivity from the 3 km LAPS in relation to the 1944z MRMS merged reflectivity QC composite. Note the new individual cells developing across west central Texas on the MRMS Composite and the nearly similar forecast by the 3 km LAPS in both time and space. However, the LAPS forecasts do have their limitations, as the forecasts produced from the initial LAPS product are a function of the WRF. Note the LAPS forecast was not able to handle the timing of the linear complex moving across the FWD forecast area (eastern side of image). The LAPS forecast was a slower and favored individual cells within a line, rather than the complex line that developed and surged eastward.
(09may13_laps-mrms.png)

With this event, the LAPS has been a valuable mesoanalyst tool this afternoon, especially within combination with the other short range guidance/mesoscale models.
Kurtz

CI/CTC identifying developing convection in a favorable environment

Posted on May 9, 2013 by greg.stumpf

The western sections of the San Angelo TX CWA have become quite favorable for

thunderstorm development. First, here is a look at the sounding from nearby Midland TX at 12Z.

The LAPS 1km (OUN domain) data showed that the dryline in this area would activate explosively, in an area with 3000 J/KG CAPE (first image, top right corner) and LI values near -10 C (first image, bottom left corner). The second image is after the storms are mature, so these values diminish with time due to the convection (perhaps too aggressively ahead of the convection).

A warning was issued based on this data. The polygon was massaged to incorporate both aggressive CI signal to the south and CTC signal to the north. The UAH CI product was persistent in depicting 90 plus percent probabilities of CI while the CTC product indicated 10 to 15 degrees of cooling over a 15 minute interval. No reports were received to verify the warning, but MESH did end up indicating values of 0.87 inches, which has correlated to severe hail in past events and similar environments this week.
(File: LAPS1km17Z-storms_05091830Z.png, LAPS1km17Z-storms_05091930Z.png

–Hatzos/Guseman

Comparison of LAPS 3 km Reflectivity and KMAF Reflectivity across Beautiful W TX/SE NM

Posted on May 14, 2013 by greg.stumpf

This is a image of LAPS_OUN_3 km run from 15 UTC 05/14/13 for 18 UTC compared to actual 0.5 Degree reflectivity from KMAF at 18 UTC. The LAPS data were nearly dead on with the location, coverage, intensity, and storm mode with the storms southwest of Midland with perhaps a slight underestimation of activity near the NM/TX border.

LAPS again. Higher CAPE, bow echo. Lower CAPE, bye bye bow echo.

Posted on May 14, 2013 by greg.stumpf

In my opinion, the LAPS surface-based CAPE product was one of the stars of the day. Consistently, storms lived and died based on entering and exiting the tongue of higher CAPE values which extended north and northeast from the Big Bend area for most of the day.

This first image shows the LAPS surface-based CAPE at 00Z, and the radar at the same time. Shouldn't be hard to pick out the storm of interest. Note that the storm is still in the tongue of 1000+ J/kg of CAPE as noted on LAPS.

One hour later, the storm is exiting and entering a less favorable instability regime. And predictably, it starts to weaken.
Any questions? LAPS nailed it.
CL

LAPS analysis shows off its utility!

Posted on May 14, 2013 by greg.stumpf

The storms over west Texas continue to build, and we expect some strengthening as they interact with a more favorable environment to the east over the next few hours. Here are a couple of images that show the beginnings of this process, as well as the level of situational awareness that can be provided by the 3km LAPS analyses. This first image shows the LAPS surface-based CAPE at 1930Z, along with the 0.5 base reflectivity at KSJT at the same time. Note the strong cell 4 counties due west of the RDA. This storm is moving towards the higher CAPE areas as noted by the bluer colors on the LAPS analysis. What will happen when it reaches a better environment? (LAPS_radar_051413_1930.png)

An hour later, we have the answer. The image below shows that the storm has strengthened considerably after moving into the more unstable regime. The warning forecaster watching this storm issued a test warning about 15-20 minutes after this image, with MESH values of 1.5 inches being seen. LAPS definitely helped to explain how this storm was able to build into our first warnable storm of the day!
(LAPS_radar_051413_2030.png)

CL

Why are storms struggling early? LAPS to the rescue again…

Posted on May 15, 2013 by greg.stumpf

The cells that have formed in the western portion of the FWD CWA have so far been fairly pedestrian. Initially, this was puzzling, as there appeared to be several favorable factors for more vigorous activity. My partner here pulled up my favorite product, the LAPS CAPE analysis, and he may have found the answer. The storms are forming along an instability gradient (the blue/green interface towards the bottom of the image), and moving eastward into an area that was worked over by morning convection (lighter blue colors). So, they waddle along and weaken in the more hostile environment. Mystery solved, at least partially! Still expecting more exciting weather soon as a watch just went up.

CL

18Z LAPS vs Reality

Posted on May 15, 2013 by greg.stumpf
The 18Z LAPS 4-hour forecast of sfc layer maximum reflectivity showed the development of a large, supercellular storm near the Gray / Montague border. Golfball- to baseball-sized hail has been reported with this storm.
Picca

LAPS on the right way regarding dryline organization and decaying storms

Posted on May 15, 2013 by Kristin Calhoun
I was wondering why LAPS constantly showed weakening trends with discrete storms entering a north-south aligned CAPE tongue just west of KABI. Rapid strengthening occurred just after initiation: LAPS 1km overlaid with reflectivity/VIS. (initiation_21Z,bmp) CAPE (LAPS) peaked in excess of 2000 J/kg in the area where storms were expected to move in. However, as seen below, storms gradually weakened during the following scans and so did the CAPE plume in LAPS: (initiation_2130Z.bmp)

The guess is that there was some strengthening of the dryline with enhanced postfrontal mixing occurring (personal talk). Also, there might be an evolving dryline bulge to the southwest of Dallas. Accompanied broadening area of backing winds is now present to the east/northeast of the decaying storms and the focus for initiation of most intense storms in the next few hours remains next to the Dallas/Fort Worth area (as constantly seen in OUN WRF/LAPS). 2145Z features 15-20 kt SE-early surface winds in this area with rapid thunderstorm growth. Helge

LAPS_OUN 22UTC Updraft Helicity Gives 1-3 Hr Lead Time to N TX Tornadoes

Posted on May 15, 2013 by greg.stumpf

The LAPS_OUN_1km surface instantaneous updraft helicity from the 22 UTC run captured the tornadic supercell near 00 UTC between Mineral Wells and Fort Worth, Texas. The 0015 UTC instantaneous updraft helicity from the 22 UTC run is depicted above. The kfws 0.5 reflectivity at 0015 UTC is depicted below. The instantaneous updraft helicity is maxed out very close to the location of the supercell. The 21 UTC LAPS_OUN run indicated some

potential for tornadic supercells across northwest Texas 23-24 UTC, which was about 50 to 100 miles too far northwest than what actually occurred. Michael Scotten

LAPS_OUN 1 km Handles Svr Bow Echo/Supercells Very Well

Posted on May 15, 2013 by greg.stumpf

LAPS_OUN 1 km did a fine job capturing a bow echo over southern Oklahoma and isolated supercells northwest of the Dallas/Ft. Worth metroplex with 1-3 hr of lead time. The top image is the 2 hr forecast for 00 UTC 16 May 13 from the 22 UTC run 15 May 13. The bottom image is 0.5 reflectivity from kfws at 2353 UTC.

3 km LAPS Forecast for Comparison with OUN WRF

Posted on May 16, 2013 by Kristin Calhoun

Looking at the 18Z run of the 3km LAPS…the model has a ribbon of north-south oriented CAPE further west into eastern Colorado than the Nearcast model and is much skinner. (LAPS_NOWCAST_CAPE1-1024x301.png)

Much lower values of CAPE are forecast in far eastern Colorado into western Kansas…and as a result…the storms that fire along the sfc convergence boundary in eastern CO develop quick but quickly die as they move off into the lower CAPE fields along the CO/KS border. This is more or less opposite the Nearcast model.
(LAPS_Combined_reflCAPE-1024x509.png)
In a similar fashion…updraft helicity is relativly weak throughout the region although the storm in eastern Yuma county has more persistent helicity field maximized at 58 m2/s2 at 22Z.
Composite radar verification at 22z indicates the 18Z LAPS run is slow to move the strongest convection in northwest Kansas to the southeast and is significantly further west with the storms than reality in southeast Colorado. In addition…the LAPS convection is weaker than reality.
22zcomp-1024x774.png

Looking at the 21Z run…the CAPE ribbon is a bit further east than the previous run and the model is capturing the return flow of higher instability as moisture is advecting in from the southeast. However…the slower advection of moisture as seen on the surface obs makes me think the LAPS is a bit aggressive with this moisture return. The reflectivity fields both along the line in northwest Kansas and the weak cluster in southeast Colorado are better

analyzed initially although are a bit weaker than reality at 23Z. The 21Z run does however show the cold pool associated with the squall line really well as it traverses southeast across GLD CWA. It also has very good definition of the individual cell's cold pool boudaries as well.
*see image /bmazur/23ZLAPSanalysis.png
*see image /bmazur/23zcomp.png

I would like to attach an image of the 3km instantaneous updraft helicity as well but am not able to load the data at this time.
An interesting feature showed up at the 2115Z timestep of the 21Z run. A donut of nearly 5000 J/kg of CAPE showed up surrounding a weak isolated cell in Prowers county. This area of high CAPE was then dispersed with time along the CAPE ribbon. Not sure what would cause this in the model but found it to be an interesting feature.
*see image /bmazur/capebomb.png
RJM

Can it be…LAPS CAPE is wrong?

Posted on May 16, 2013 by Kristin Calhoun

Storms continue in a linear convective mode across the GLD CWA. The 18Z run of the LAPS suggested lower instability ahead of the line as it continues to sink south. Here is the current setup. As you can see, the storms are maintaining some level of strength as they move into this supposedly more hostile environment. The mesoscale desk noted that the GOES NEARCAST products maintained higher instability across the CWA and are probably more correct in this scenario. Just goes to show that no product is right all of the time, or even most of the time!
CL (LAPS_radar_051613_2153.png)

Comparison of OUN-WRF / 3km LAPS / Actual Reflectivity

Posted on May 16, 2013 by Kristin Calhoun

Setting up shop in North Platte, NE today. Quite a marginal setup with relatively low instability / higher based storms based upon Nearcast, higher res LAPS, and more conventional data. Enough shear to organize structures into small line segments at present. Here's a comparison of some of the higher res model Z output and actual Z at 2100Z. Neither have reality nailed perfectly, but it looks like the OUN-WRF has a slightly better idea of the structure, whereas LAPS has more discrete cells.
Actual Reflectivity
(mosaic-1024x587.png)

OUN-WRF (ounwrf_ximz-1024x599.png)
LAPS (laps_oun_sim_z-1024x599.png)

LAPS performance with decaying thunderstorm cluster

Posted on May 16, 2013 by Kristin Calhoun

A short overview about how the LAPS handled both the decaying cluster of storms but also isolated thunderstorm activity further to the south. Both models, OUN WRF (not shown) and 3 km LAPS tried to strengthen the northern part of that line despite real time radar data showing a constant weakening trend. In contrast, the southern part was captured very well, both in space, timing and strength of those cells. Until now, model's QPF was lower than the real time radar showed, which likely resulted in a stronger outflow boundary to set up to the SW of the thunderstorms. LAPS had the outflow boundary more to the east and in a north-south fashion. In the near term, LAPS weakens the southern part of the line, which is in line with rapidly decreasing CAPE values further downstream….latest radar trend partially confirms that with some ongoing re-development along the SE fringe (where warm/moist inflow continues to feed the system).

LAPS captured isolated storms further to the south very well. As they moved off the mountains they entered a drier air mass to the east and weakened both in model data but also in reality. LAPS sends at least one healthy outflow boundary to the NW which collides with aforementioned extensive outflow boundary from the N/NE in the model's world. Not sure if that's real, as mountain storms looked ill and revealed stronger cores only for a short amount of time. Nevertheless, we continue to monitor both eastward progressing cells and northwestward motion of the outflow boundary. Helge

S Nebraska Line Segment & LAPS

Posted on May 16, 2013 by Kristin Calhoun
The weak line segment progressing across S NE did indeed seem to lead to new development (upon its leading outflow boundary) as it reached an axis of better surface-based instability to its east, as analyzed by the 3-km LAPS. Another example of the good visualization / analysis tool of reflectivity + LAPS CAPE.
21Z LAPS analysis of 2130Z SBCAPE + Reflectivity Mosaic (region of approx 1500 J/kg CAPE is scalloped)

Meso-Scale LAPS_OUN_1km

Posted on May 21, 2013 by greg.stumpf

2015ZRadar.png, LAPS_dbz_valid2015Z.png, LAPS_dbz_valid2030Z_21may13.png
I like the 15 min forecast time steps of the LAPS_OUN_1km data. The most noticeable feature is a secondary sfc CAPE maximum about 2 counties out ahead of the current line of convection. The LAPS fcst maximum base reflectivity continues to try and develop a secondary line of potentially severe convection 50 to 60 miles out ahead of the current line of convection over east TX. May want to watch satellite for cloud cooling trends and possible initiation of new severe convection out ahead of the current line of storms over east TX. These new cells would be forming in a very volatile environment and thus will quickly become severe assuming they form as LAPS data has been trying to indicate. Thus far this new convection out ahead of the line has not been forming, but should be monitored as the LAPS is persistent in trying to develop this convection.
Wesely

LAPS CAPE Forecasts and Radar Observations…

Posted on May 20, 2013 by Gabe Garfield
The following imagery are taken from the 21 UTC forecast run of the 1 km LAPS model and are overlaid with KTLX 0.5 reflectivity imagery. At the first image below, valid at 21 UTC, or the model initialization time, you can see the ribbon of high CAPE values, exceeding 4-5000 J/KG is some areas, stretching from SW-NE across portions of north Texas and central Oklahoma. The radar imagery initially are valid at 2116 UTC. Notice the large supercell over the Red River in Clay and Jefferson Counties. The LAPS CAPE values can serve as a proxy of sorts for the resulting reduction of CAPE in association with the outflow from this storm. In subsequent imagery, the outlow (or relatively low CAPE field) can be seen to migrate quickly northward. In image 2, the wind at KPJV is observed to shift from the south, as the outflow boundary crossed the area. The timing matched the LAPS forecast values quite well. Later, in images 3 and 4, as the outflow boundary intersected an area of higher CAPE in the OK City metro, a small storm suddenly develops. The timing of the propagating outflow boundary was handled very well by the LAPS model in this particular case.
Too bad we couldn't show a loop of the imagery, because the LAPS' handling of the outflow from the convection was rather stunning.

2.1 2-D configuration from vLAPS 2.5-km surface analysis only for supporting situation awareness

Ashlie Sears, General Forecaster, NWS Upton NY (New York City) 2013 Week 3 Evaluator

Mesoscale Analysis Tools

· **OUN-WRF and LAPS 1km and 3 km forecasts cannot be utilized up here in the Northeast. However, the LAPS 2.5 km analysis is available to be used at this time. I found during our warning situations that using the Theta-E values from LAPS was a best practice in figuring out where the convection was going to initiate and continue to form. The ability of AWIPS2 to allow multiple layers to be easily overlaid and the easy access with zooming in and out without constantly having to reload the frame allowed the forecaster to analyze the situation at a much quicker pace as well as obtain a much clearer picture. I found it beneficial overlaying the analyzed 2.5 km CAPE values with the latest reflectivity images then comparing to how the LAPS 1 and 3 km forecasted these parameters over the next few hours. Overall, the LAPs had the better grasp of the type of storm development and the location though the timing was off by up to 1-2 hours. It also is run at 15 minute intervals, allowing a more up to date version of what is occurring. The OUN-WRF had a better handle of the timing of the development, but was off on the location.**

· **I would really like to see the forecasted LAPS in our region of the country as it proved quite useful in determining where the most likely area of convection would be. In addition, in discussing other potential uses, the LAPS rep informed me they have found it useful in forecasting the rain/snow line, producing fairly accurate forecasts, during winter events which would also be very useful in the Northeast.**

James McCormick, UCAR Associate Scientist I, Aviation Hazards Team, 16th Weather Squadron, Air Force Weather Agency. Offutt AFB, Nebraska

Wednesday, May 22

· We were particularly interested in evaluating the LAPS products on this day to see how our mesoscale environment was being represented. Temperatures were quickly warming in central New York in the upper 70s and lower 80s. Storms formed along the theta-E maximum just south of Lake Ontario, where a lake breeze was also pushing slightly southward. An initial squall line was pushing out of the area through the eastern portion of the Albany CWA and into New England; we were more interested in convection potential behind the initial line. The SPC mesoanalysis confirmed a deep stable layer in the convective outflow.

· Two storms would develop to the north, one early in the forecast period, one a couple of hours later. Both would be severe, both would track just south of Lake Ontario, and both would be warned for by the respective CWA desks. We kept noting the theta-E maximum to the north, well represented by the LAPS imagery. At the Mesoscale Discussion desk, we focused more on the

potential for convection elsewhere, as the environment remained fairly similar along the path of the northern supercells. We also knew that the respective warning desks would likely be more focused on the ongoing storms, benefitting more from having another set of eyes on where new storms might form.

· We grew more and more concerned as the day went on about the dry air filtering into the rest of the Buffalo and Binghamton CWAs from the southwest. We kept seeing dry air signals represented in the environment, and kept noting that convection was going to struggle anywhere in western New York outside of that boundary in the northern portions of the respective CWAs. We also noted that simulated satellite imagery cleared out convection to the east and left a dryer, stable environment over much of western New York. Andrew very astutely noted that the dryer air meant that south of the northern supercells, the main severe threat was transitioning quickly to a downburst wind threat instead of a hail threat.

· That trend really defined the day. I really thought the LAPS products did a great job of holding fast to the idea that dry air – characterized by 30 degree dew point depressions – was firmly in place, and that any convection trying to go up would struggle mightily. We kept seeing storms try to fire on radar but never sustain themselves. (It was noted that we dearly missed the chance to evaluate satellite-based convective initiation products from UAH. We would have loved any help we could have gotten with the developing cumulus clouds.) Even in the presence of other high resolution models suggesting convective development in western New York, the LAPS products really made it clear that nothing substantial was to be expected. I also thought the LAPS products did a terrific job of representing moisture boundaries well. If I had a recommendation, I would love to see a dew point depression trend chart – how the DPD changes from hour to hour is quite interesting to me and would show areas where dry air is mixing out the boundary moisture.

Thursday, May 23

Our first storm of interest quickly came out of the Lubbock area, where a cloud top cooling value of -17 C/15 minutes was noted. With the GOES-13 still out, we were using satellite products that were completely reliant on the western imagery, which made values a bit different than usual given that we were on the edge of the domain where we could use the imagery at all. Our LAPS mesoscale analysis noted a rich theta-E maximum through the I-27 corridor along the boundary, and convective initiation occurred very close to this maximum (within a county). LAPS updraft helicity was more bullish in western Texas than what we saw on the OUN-WRF – I thought maybe this product's forecast was too aggressive. Basically this product was expecting, it appeared, mesocyclones along the entire dry line during initial convective development. Both the OUN-WRF and the LAPS products gave us the idea that storms that went up initially would threaten with all forms of severe weather, and the Lubbock area storm quickly gave each of the threats, including

extremely damaging winds in excess of 100 MPH.

The first storm in the AMA area developed a massive circular outflow that extended all directions, including back to the northwest along the dry line. We noted that it took the LAPS an hour or so to catch on to the colder, more stable air infiltrating the AMA area. What was seemingly a prime area for convective development has now become much more stable due to mesoscale influence. After a couple of weak convective attempts on the outflow boundary, a storm showed a -18 C/15 minutes cloud top cooling value in Potter County. This storm did become severe for a couple of scans. Chad Gravelle had asked us to watch the CTC product near radars – this storm was very near the AMA radar, and the algorithm performed quite well. This storm, with large scale winds working directly in opposition to the motion of the low level forcing, had a motion of nearly 0, contrary to the projection of a progressive complex that several models had advertised. This storm lasted for a couple of warnings before dissipating. Away from the forcing of the outflow boundary, the storm could not exist in the ouflow cooled air.

LAPS Observations and Determining Future Storm Development…

Posted on May 20, 2013 by Gabe Garfield

Just a quick post about observations of the LAPS theta-e field this afternoon. It was interesting to see the near stationary aspect of the theta-e boundary in assoc/w the dryline to our south across portions of north Texas this afternoon. This suggests that continued development is possible late this afternoon especially across northern Texas, where the gradients have been sustained and have even increased lately. However, notice that the gradients have decreased generally across much of Oklahoma where convection and related effects (rain cooled air, cloud shield) have helped to stabilize the environment. The 15-minute temporal resolution of the product can be very useful for diagnosing locations of continued convection especially in rapidly developing convective situations.

EWP Mesoscale Discussion 2330 UTC

Posted on May 22, 2013 by Gabe Garfield

A severe threat continues in Oswego and Oneida counties… where an intense thunderstorm continues to move eastward, and golfball sized hail was recently reported in Central Square. The storm continue to move into a region of theta-E characterized by values of greater than 342 K… and lower dew point depressions near 10 K.
Farther to the south… dry air continues to dominate much of the southern portion of the BUF CWA and the southwestern portion of the BGM CWA. Convection has tried to develop throughout the cumulus field throughout the afternoon… but the substantial

convection to this point has been confined to a narrow ribbon of moisture rich air just south of Lake Ontario, as previously discussed.

One exception is near Sullivan County PA in the southern portion of the BGM CWA… where a small region of higher moisture is indicated by the LAPS analysis. In addition to a threat of strong winds… as DCAPE values exceed 800 J/kg in a region with dew point depressions approaching 30 degrees F in some cases… a marginal severe hail threat is also evolving for the BGM area in Sullivan and Bradford Counties in the next couple of hours where LAPS is indicating higher surface dew points. Recent radar trends indicate that reflectivity above 0 C has increased in recent scans as well.

– Zimmerman/McCormick

Storms Along the SJT/MAF Border

Posted on May 23, 2013 by greg.stumpf

An earlier cell merger helped enhance low-level rotation and produced a reported tornado near Rotan in Fisher County TX in SJTs area. The mid-level meso would eventually track SW toward Scurry and Mitchell Counties in the MAF forecast area. The LAPS streamline analysis at 2330 UTC indicated convergence over the northeast portion of the MAF CWA, which appeared to be concentrating higher theta-e values in the location likely allowing the stronger convection to translate west of south. (figure in the paper, streamline analysis)